CLAIMS

1. A relaxor ferroelectric solid solution single crystal, characterized in that the relaxor ferroelectric solid solution single crystal is capable of making transitions, at temperatures below the Curie temperature, between a first state which has a high permittivity and blocks optical transmission and a second state which has a low permittivity and allows optical transmission, wherein the relaxor ferroelectric solid solution single crystal undergoes a transition to the second state if an electric field above a threshold is applied in the first state.

2. The relaxor ferroelectric solid solution single crystal according to claim 1, characterized in that the relaxor ferroelectric solid solution single crystal undergoes a transition to the first state if heated to or above the Curie temperature in the second state.

3. The relaxor ferroelectric solid solution single crystal according to claim 1 or 2, characterized in that relative permittivity of the relaxor ferroelectric solid solution single crystal is 9,000 or above in the first state, and 7,000 or below in the second state.

4. The relaxor ferroelectric solid solution single crystal according to any one of claims 1 to 3, characterized in that the relative permittivity is approximately halved when the relaxor ferroelectric solid solution single crystal makes a transition from the first state to the second state.

5. The relaxor ferroelectric solid solution single crystal according to any one of claims 1 to 4, characterized in that the relaxor ferroelectric solid solution single crystal is made of a lead-based complex perovskite compound.

6. The relaxor ferroelectric solid solution single crystal according to claim 5, characterized in that the lead-based complex perovskite compound is expressed as any of $(1-x)Pb(Mg_{1/3}Nb_{2/3})O_3 \cdot xPbTiO_3$, $(1-x)Pb(Zn_{1/3}Nb_{2/3})O_3 \cdot xPbTiO_3$, and $(1-x)Pb(In_{1/2}Nb_{1/2})O_3 \cdot xPbTiO_3$.

7. The relaxor ferroelectric solid solution single crystal according to claim 6, characterized in that x is larger than 0.1 and smaller than 0.2.

8. The relaxor ferroelectric solid solution single crystal according to any one of claims 5 to 7, characterized in that the lead-based complex perovskite compound of the relaxor ferroelectric solid solution single crystal is a pseudocubic/rhombohedral phase (001) plate.

9. A relaxor ferroelectric solid solution single crystal, characterized in that it is made of a lead-based complex perovskite compound expressed as any of $(1-x)Pb(Mg_{1/3}Nb_{2/3})O_3 \cdot xPbTiO_3$, $(1-x)Pb(Zn_{1/3}Nb_{2/3})O_3 \cdot xPbTiO_3$, and $(1-x)Pb(In_{1/2}Nb_{1/2})O_3 \cdot xPbTiO_3$, where x is larger than 0.1 and smaller than 0.2.

10. The relaxor ferroelectric solid solution single crystal according to claim 9, characterized in that the lead-based complex perovskite compound of the relaxor ferroelectric solid solution single crystal is a pseudocubic/rhombohedral phase (001) plate.

11. A device using the relaxor ferroelectric solid solution single crystal according to any one of claims 1 to 10.

12. The device according to claim 11, wherein the device is an optical device which uses at least optical characteristics

of the relaxor ferroelectric solid solution single crystal.

13. The device according to claim 12, wherein the optical device is an optical memory or light valve.

14. The device according to claim 12 or 13, wherein the device uses not only the optical characteristics, but also changes in dielectric characteristics of the relaxor ferroelectric solid solution single crystal taking place with changes in the optical characteristics.

15. A method of using a device that incorporates a relaxor ferroelectric solid solution single crystal, wherein the relaxor ferroelectric solid solution single crystal is capable of making transitions, at temperatures below the Curie temperature, between a first state which has a high permittivity and blocks optical transmission and a second state which has a low permittivity and allows optical transmission, and the relaxor ferroelectric solid solution single crystal undergoes a transition to the second state if an electric field above a threshold is applied in the first state and undergoes a transition to the first state if heated to or above the Curie temperature in the second state, the method being characterized by:

applying an electric field above a threshold to the relaxor ferroelectric solid solution single crystal in the device to cause the relaxor ferroelectric solid solution single crystal to make a transition from the first state to the second state; and

heating the relaxor ferroelectric solid solution single crystal in the device to or above the Curie temperature to cause the relaxor ferroelectric solid solution single crystal to make a transition from the second state to the first state.